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LAMBTON AREA WATER SUPPLY

(SARNIA)

DRINKING WATER SURVEILLANCE PROGRAM

ANNUAL REPORT - 1986

MAY, 1987

Ontario
Ministry of the Environment

J. Bishop, Director
Water Resources Branch

LAMBTON AREA WATER SUPPLY

(SARNIA)

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PROGRAM

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ONTARIO MINISTRY OF THE ENVIRONMENT

Southwestern Region

LAMBTON AREA WATER SUPPLY (Sarnia)

Location:	1215 Fort Street, P.O. Box 790 Sarnia, Ontario (519-344-7429)
Source:	Lake Huron/St. Clair River
Design Capacity:	181.8 1000 M3/day
Operation:	Ministry of the Environment
Plant Superintendent:	J. Horsburgh
Ministry Region:	Southwestern Region London Regional Office 985 Adelaide Street South London, Ontario N6E 1V3 (519-661-2200)
Municipalities Served:	Point Edward Village (2,373) Sarnia City (50,233) Sarnia Township (20,913) Moore Township (10,097) Sombra Township (4,249)
Treatment Type:	Physical and chemical treatment consisting of coagulation, flocculation and direct filtration with disinfection and fluoridation.
Chemicals Used:	Prechlorination - chlorine Coagulation - alum liquid with polyelectrolyte as needed Post chlorination - chlorine Fluoridation - hydrofluosilicic acid

LAMBTON AREA WATER SUPPLY
(SARNIA)

EXECUTIVE SUMMARY
DRINKING WATER SURVEILLANCE PROGRAM, 1986

The Lambton Area Water Supply (Sarnia) was sampled 9 times after April 30, 1986; results are given for raw and treated samples.

The parameters analyzed fall into several categories: physical parameters and general chemistry, bacterial parameters, metals, and organic substances including volatile and chloroaromatic substances and pesticides.

The discussion of results focuses on health-related parameters found in treated water:

(a) **Organic Substances**

Analysis was carried out for approximately 110 organic compounds. The only volatile compounds found, trihalomethanes (THMs) were always present in treated waters; the highest level recorded for total THMs was 56 ug/L.

None of the pesticides analyzed for was found.

No chlorophenolic or chloroaromatic compounds were found.

(b) **Other Parameters**

The aesthetic ODWO* for organic nitrogen was exceeded in one treated water sample. Of the other physical, general chemistry and microbiological parameters and metals analyzed, for which there are health-related ODWO, none exceeded the objectives, in treated water.

The results of these analyses are consistent with those obtained in other areas of the Great Lakes.

The treated water from the supply did not exceed any known health-related guidelines for organic substances applicable to drinking water.

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* The Ontario Drinking Water Objectives, revised 1983.

LAMBTON AREA WATER SUPPLY
(SARNIA)

SUMMARY TABLE OF RESULTS
DRINKING WATER SURVEILLANCE PROGRAM, 1986

The Lambton Area Water Supply (Sarnia) was sampled 9 times after April 30, 1986

PARAMETER CATEGORY	TYPE OF SAMPLE RAW	TREATED*
1. GENERAL CHEMISTRY - includes anions such as sulphate, field analyses such as chlorine residual and physical parameters such as colour.		
Total number of parameters in category: 21		
- Total number of analyses completed	162	144
- Total number of positive results	129	103
- **Number of times guidelines exceeded**	**N/A**	**1**
Guidelines exceeded - aesthetic ODWO** for organic nitrogen (1)		
2. METALS - includes metals such as copper and lead.		
Total number of parameters in category: 24		
- Total number of analyses completed	194	173
- Total number of positive results	90	75
- **Number of times guidelines exceeded**	**N/A**	**0**
3. BACTERIOLOGY - includes bacteria such as coliforms.		
Total number of parameters in category: 5		
- Total number of analyses completed	35	31
- Total number of positive results	20	3
- **Number of times guidelines exceeded**	**N/A**	**0**
4. VOLATILES - includes compounds such as benzene and toluene; also included in this category are trihalomethanes (5 parameters), acknowledged to be produced during water treatment.		
Total number of parameters in category: 29		
- Total number of analyses completed	251	223
- Total number of positive results	8	32
- **Number of times guidelines exceeded**	**N/A**	**0**
5. PESTICIDES -		
Total number of parameters possible in category: 65		
- **Total number of analyses completed**	307	275
- Total number of positive results	0	0
- **Number of times guidelines exceeded**	**N/A**	**0**
6. CHLOROAROMATICS AND CHLOROPHENOLS - includes a range of chlorinated organic compounds.		
Total number of parameters possible in category: 19		
- **Total number of analyses completed**	129	116
- Total number of positive results	0	0
- **Number of times guidelines exceeded**	**N/A**	**0**

* **Total number of analyses completed will not always equal the number of parameters analyzed for multiplied by number of times the supply was sampled, because of accidents during shipping or analyses or analytical difficulties.**

** **Ontario Drinking Water Objective.**

DRINKING WATER SURVEILLANCE PROGRAM

The Drinking Water Surveillance Program (DWSP) for Ontario is a computerized drinking water information system. The objectives of this program are to provide:

- immediate, reliable, current information on drinking water quality,
- a flagging mechanism for 'Objective' exceedence,
- a definition of contaminant levels and trends,
- a comprehensive background for remedial action,
- a framework for assessment of new contaminants,
- an indication of treatment efficiency of plant processes.

Program

The DWSP began in April 1986 and is designed to eventually include all municipal water supplies in Ontario. Water supply locations have been prioritized for surveillance, based primarily on such criteria as population density, probability of contamination and geographical location.

Once the data base becomes established, an assessment of monitoring requirements for the future will be made; monitoring will be continued at the initial locations at an appropriate level and further locations will be phased on to the program as resources permit. It is

estimated that after 4 years of operation, the program will be monitoring 90 locations.

A major goal of the program is to collect valid water quality data, in context with plant operation characteristics in the plant at the time of sampling.

Assessments are carried out at all locations prior to sampling in order to acquire full plant process and distribution system details, and to designate (and retrofit if necessary) all sampling systems and locations.

Samples are taken of the raw (ambient water quality) and treated water at the treatment plants, and also in the distribution systems. In order to determine possible effects of distribution on water quality, both standing and flowing water in old and new sections of the distribution system are sampled. Sampling is carried out by Ministry of the Environment (MOE) Regional staff and/or Municipal personnel who have been trained in the applicable procedures. Comprehensive sampling kits and documented sampling procedures are made available to samplers. This ensures that samples are taken and shipped according to standard protocols and that field testing will supply reliable data. All analyses are carried out using approved documented procedures.

Data Reporting Mechanism

Final analytical results are usually received by the DWSP reporting system within 6 weeks of the time of sampling. At this time, printouts of the completed analyses are sent to the MOE District Officer and the appropriate MOE regional office, and are also retained by the DWSP co-ordinator. The DWSP is able to monitor analysis results and assess trends. Should the level of

a contaminant exceed a health-related Ontario Drinking Water Objective, action is required as outlined in the publication, Ontario Drinking Water Objectives.* The DWSP issues an "Action Alert" which notifies appropriate MOE and health authorities, and supplies a history of the occurrence of the contaminant in the water supply system concerned.

Parameters Analyzed

About one hundred and forty (140) different parameters are routinely measured on DWSP covering microbiological, organic and inorganic substances of concern, as well as process parameters.

Parameters included in the program are based on the following criteria:

- probability that the substance has the potential to cause problems (health-related or aesthetic);
- probability of occurrence in ambient water;
- availability of routine analytical and sampling methods for monitoring and control purposes;
- feasibility of control.

The range of parameters includes those having Ontario Drinking Water Objectives (ODWO), World Health Organization Drinking Water Guideline values, or other

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* Ontario Drinking Water Objectives, revised 1983, published by the Ontario Ministry of the Environment.

jurisdiction's drinking water objectives (e.g. State of California) as well as compounds of concern to other agencies such as the International Joint Commission, and U.S. Environmental Protection Agency.

The parameters monitored routinely during 1986 are shown in Table 1; this table also includes available guidelines which are appropriate for drinking water, and the analytical detection limit (the lowest concentration that can be detected by laboratory analysis) for each parameter.

Analyses for additional pesticides may be included on certain sampling dates; such additional pesticides are selected from the list shown in Table 1A. These analyses may be done on a seasonal basis, in response to an identified concern or because of a potential for occurrence in certain locations. Seasonal analyses for specified additional pesticides are normally carried out at times corresponding to maximal agricultural use or run-off periods, i.e. in spring and fall seasons.

Drinking Water Guidelines

The Ministry of the Environment published a revised edition of "Ontario Drinking Water Objectives" in 1983.

The primary purpose of drinking water objectives is the protection of the health of the public consuming the water. Aesthetic considerations may also provide a basis for drinking water objectives, since the water should be pleasant to drink. The control of such aspects of water quality as hardness, corrosiveness, etc. is also important. The limits set are considered to outline the minimum requirements necessary to fulfill the above objectives, and may be either health-related or related to aesthetic and other considerations.

Because this survey covered such a large number of parameters, many of them did not have an ODWO. In order to be able to compare data results to health guidelines, it was necessary to refer to objectives and guidelines developed by other jurisdictions.

The footnotes to Table 1 indicate the sources and derivation of the various guidelines.

TABLE 1: DRINKING WATER SURVEILLANCE PROGRAM, PARAMETERS ANALYSED

PARAMETER CATEGORY	Objective Guideline (1)	Detection Limit	PARAMETER CATEGORY	Objective Guideline (1)	Detection Limit
CHEMISTRY:			Barium	1 mg/L	0.001 mg/L
Conductivity	-	0.01 UMHO/CM	Boron	5 mg/L	0.02 mg/L
			Beryllium	-	0.001 mg/L
Hardness	-	0.5 mg/L	Cyanide	0.2 mg/L	0.001 mg/L
Calcium	-	0.1 mg/L	Cadmium	0.005 mg/L	0.0003 mg/L
Magnesium	-	0.05 mg/L	Cobalt	-	0.001 mg/L
Sodium	-	0.1 mg/L	Chromium	0.05 mg/L	0.001 mg/L
Alkalinity		0.2 mg/L	Copper	1 mg/L	0.001 mg/L
pH	-	-	Mercury	1 µg/L	0.01 µg/L
Fluoride	2.4 mg/L	0.01 mg/L	Molybdenum	-	0.001 mg/L
Chloride	250 mg/L	0.2 mg/L	Nickel	-	0.002 mg/L
Residue total (solids)	-	1 mg/L	Lead	0.05 mg/L	0.003 mg/L
Turbidity	1 FTU	.01 FTU	Selenium	0.01 mg/L	0.001 mg/L
Phosphorus	-	0.002 mg/L	Strontium	-	0.001 mg/L
Phosphates	-	0.0005 mg/L	Vanadium	-	0.001 mg/L
Nitrogen Total Kjeldahl	0.15 mg/L*	0.1 mg/L	Zinc	5 mg/L	0.001 mg/L
Ammonium Total	-	0.05 mg/L			
Colour	5 TCU	0.5 TCU	BACTERIOLOGY (RAW ONLY):		
Nitrates Total	10 mg/L as N	.05 mg/L	Total Coliform MF	-	0
			Total Coliform MF BKGD	-	0
Nitrite	1 mg/L as N	0.0005 mg/L	Fecal Coliform	-	0
			Standard Plate Count MF	-	0
METALS:			(TREATED ONLY):		
Uranium	0.02 mg/L(t)	0.002 mg/L‡	Present/Absent (P/A) Test	Absent	Absent
Iron	0.3 mg/L	0.002 mg/L	Total Coliform MF BKGD	-	0
Manganese	0.05 mg/L	0.001 mg/L	Fecal Coliform	0	0
Aluminum	-	0.003 mg/L	Standard Plate Count MF	<500 orgs/mL	0
Arsenic	0.05 mg/L	0.001 mg/L			

TABLE 1: DRINKING WATER SURVEILLANCE PROGRAM, PARAMETERS ANALYSED (cont'd)

PARAMETER CATEGORY	Objective Guideline (1)	Detection Limit	PARAMETER CATEGORY	Objective Guideline (1)	Detection Limit
VOLATILES:			CHLOROAROMATICS:		
1,1-Dichloroethylene	0.3 µg/L(h)	1.0 µg/l	Hexachloroethane	19000 ng/L(e)	1 ng/L
Dichloromethane	40 µg/L(c)	5 µg/L	1,3,5-Trichlorobenzene	10000 ng/L(y)	5 ng/L
TRS-1,2-Dichloroethylene	-	1 µg/L	1,2,4-Trichlorobenzene	15000 ng/L(y)	5 ng/L
1,1-Dichloroethane	-	1 µg/L	Hexachlorobutadiene	4500 ng/L(e)	1 ng/L
Chloroform	350 µg/L++	1 µg/L	1,2,3-Trichlorobenzene	10000 ng/L(y)	5 ng/L
1,1,1-Trichloroethane	1000 µg/L(c)	1 µg/L	2,4,5-Trichlorotoluene	-	5 ng/L
1,2-Dichloroethane	10 µg/L(h)	1 µg/L	2,3,6-Trichlorotoluene	-	5 ng/L
Carbon Tetrachloride	3 µg/L(h)	1 µg/L	1,2,3,5-Tetrachloro-benzene	-	1 ng/L
Benzene	10 µg/L(h)	1 µg/L	1,2,4,5-Tetrachloro-benzene	38000 ng/L(e)	1 ng/L
1,2-Dichloropropane	-	1 µg/L	2,6,A-Trichlorotoluene	-	5 ng/L
Trichloroethylene	30 µg/L(h)	1 µg/L	1,2,3,4-Tetrachloro-benzene	-	1 ng/L
Dichlorobromomethane	350 µg/L++	1 µg/L	Pentachlorobenzene	74000 ng/L(e)	1 ng/L
Toluene	100 µg/L(c)	1 µg/L	Total PCB's	3000 ng/L(t)	20 ng/L
1,1,2-Trichloroethane	6 µg/L(e)	1 µg/L			
Chlorodibromomethane	350 µg/L++	1 µg/L	PESTICIDES:		
Tetrachloroethylene	10 µg/L(h)	1 µg/L	Hexachlorobenzene	10 ng/L(h)	1 ng/L
Chlorobenzene	100-300 ng/L(h)*	1 ng/L	Heptachlor	3000 ng/L+++	1 ng/L
Trifluorochlorotoluene	-	1 µg/L	Aldrin	700 ng/L**	1 ng/L
Ethylbenzene	1400 µg/L(e)	1 µg/L	PP-DDE	d	1 ng/L
Ethylene Dibromide	0.02 µg/L(x)	1 µg/L	Mirex	-	5 ng/L
P-Xylene	620 µg/L(c)	1 µg/L	Alpha BHC	700 ng/L(c)	1 ng/L
M-Xylene	620 µg/L(c)	1 µg/L	Beta BHC	300 ng/L(c)	1 ng/L
O-Xylene	620 µg/L(c)	1 µg/L	Gamma BHC (Lindane)	4000 ng/L	1 ng/L
Total Trihalomethanes	350 µg/L++	3 µg/L	Alpha Chlordane	7000 ng/L***	2 ng/L
Bromoform	350 µg/L++	1 µg/L	Gamma Chlordane	7000 ng/L***	2 ng/L
1,1,2,2-Tetrachloroethane	1.7 µg/L(e)	1 µg/L	Oxychlordane	-	2 ng/L
1,4-Dichlorobenzene	400 µg/L(e)	1 µg/L			
1,3-Dichlorobenzene	400 µg/L(e)	1 µg/L			
1,2-Dichlorobenzene	400 µg/L(e)	1 µg/L			

TABLE 1: DRINKING WATER SURVEILLANCE PROGRAM, PARAMETERS ANALYSED (cont'd)

PARAMETER CATEGORY	Objective Guideline (1)	Detection Limit	PARAMETER CATEGORY	Objective Guideline (1)	Detection Limit
Pesticides (cont'd)					
OP-DDT	30000 ng/L(d)	5 ng/L			
PP-DDD	d	5 ng/L			
PP-DDT	d	5 ng/L			
Methoxychlor	100000 ng/L	5 ng/L			
Heptachlor Epoxide	3000 ng/L+++	1 ng/L			
Endosulfan 1	74000 ng/L(ea)	2 ng/L			
Dieldrin	700 ng/L**	2 ng/L			
Endrin	200 ng/L	4 ng/L			
Endosulfan 2	74000 ng/L(ea)	4 ng/L			
Endosulfan Sulphate	-	4 ng/L			
Octachlorostyrene	-	1 ng/L			
Toxaphene	5000 ng/L	PA(xx)			

Footnotes:

(l) = Ontario Drinking Water Objectives (ODWO) for drinking water, unless noted.

(t) = ODWO Interim maximum acceptable concentration (IMAC) for drinking water.

(c) = California State Department of Health Action Level for drinking water.

(d) = ODWO for DDT (contains other isomers such as OPDDT and PPDDT).

(e) = US EPA ambient guideline; guideline levels when it is assumed that untreated water and fish and shellfish are consumed from the same body of water.

(ea) = United States Environmental Protection Agency (US EPA) ambient level for endosulfan (contains other isomers).

(h) = World Health Organization (WHO) guideline for drinking water.

(h)* = World Health Organization (WHO) Odour Threshold for drinking water.

(x) = State of Florida, maximum contaminant level for drinking water.

(xx) = the presence of toxaphene is detected in scan used; positive samples would be quantified by special additional analysis.

(y) = New York State (Taste and Odour) proposed drinking water guideline.

++ = total Trihalomethanes.

+++ = combined total; Heptachlor and Heptachlor Epoxide.

* = total Kjeldahl Nitrogen minus Ammonia Nitrogen.

** = total of Aldrin and Dieldrin.

*** = Chlordane is a mixture of alpha and gamma isomers.

‡ = Analysis changed to mass spectrometry method in mid-1986, detection limit 0.0001 mg/L.

TABLE 1A: DRINKING WATER SURVEILLANCE PROGRAM SPECIAL PESTICIDES

Dicamba
2,4-D
2,4-DB
2,4-DP
2,4,5-T
Silvex (2,4,5-TP)
Picloram
2,4,6-Trichlorophenol
2,4,5-Trichlorophenol
2,3,4-Trichlorophenol
2,3,5,6-Tetrachlorophenol
2,3,4,5-Tetrachlorophenol
Pentachlorophenol
Diazinon
Dichlorvos
Dursban
Ethion
Guthion
Malathion
Mevinphos
Methyl Parathion
Methyl Trithion
Parathion
Phorate (Thimet)
Reldan
Ronnel
Carbofuran
Propoxur
IPC
Aminocarb
CIPC
Eptam
Benonyl
Bux
Diallate
Sevin
Sutan
Propazine
Atrazine
Simazine
Sencor (metribuzin)
Bladex (Cyanazine)
Prometone
Ametryne
Prometryne
Atratone
Alachlor
Metolachlor

TABLE 2

LAMBTON AREA WATER SUPPLY (SARNIA)

	PARAMETER GROUP	TYPE OF SAMPLE RAW	TREATED
1.	GENERAL CHEMISTRY		
	- Total samples	162	144
	- Total positives	129	103
2.	METALS		
	- Total samples	194	173
	- Total positives	90	75
3.	BACTERIOLOGY		
	- Total samples	35	31
	- Total positives	20	3
4.	VOLATILES		
	- Total samples	251	223
	- Total positives	8	32
5.	PESTICIDES		
	- Total samples	219	195
	- Total positives	0	0
6.	CHLOROAROMATICS		
	- Total samples	117	104
	- Total positives	0	0
7.	CHLOROPHENOLS		
	- Total samples	12	12
	- Total positives	0	0
8.	SPECIAL PESTICIDES		
	- Total samples	88	80
	- Total positives	0	0

RESULTS AND DISCUSSION

The parameters analyzed fall into several categories: physical parameters and general chemistry (chemistry), bacterial parameters, metals, and organic substances including volatile and chloroaromatic substances and pesticides. Many of the substances analyzed for are naturally-occurring or treatment by-products.

The results of analysis of raw and treated water samples are shown in Tables 2 and 3. Table 2 shows the categories of parameters analyzed, as well as the total number of analyses which were completed in each category for both raw and treated water samples and the total number of positive results which were obtained. Table 3 lists the sampling dates and the numerical values for each parameter for which analysis produced a positive (quantifiable) result.

The Lambton Area Water Supply (Sarnia) was sampled 9 times after April 30, 1986.

(a) Non Organic Substances

There are 232 positive results of 306 reported analyses for physical parameters, such as pH and temperature and general chemistry tests. The results of these tests are used as an indication of the analytical validity and integrity of the samples, the general characteristics of the water, and as a guide to making an assessment of the treatment process; they may also indicate whether any changes occur during the time elapsing between sampling and actual analysis. Organic nitrogen exceeded the aesthetic ODWO in one treated water sample; levels of organic nitrogen above the limit can result in taste and odour problems.

Positive results were obtained for 23 analyses for bacterial parameters out of a total number reported of 66. These bacterial tests include those for species of paramount importance from a public health point of view, and those which assess the general bacteriological quality and characteristics of the water; by this means, a measure is obtained of the overall efficiency of water treatment processes. Positive results were obtained for treated water samples for standard plate count (a measure of the total number of bacteria in a water sample). The highest count of 170 organisms per mL was on December 1, 1986. The ODWO recommend that treated water not exceed 500 organisms per mL for standard plate count.

Analyses of 367 tests for metals in the water samples were reported; of these 165 were positive results. Metals can occur naturally and most are generally regarded as being ubiquitous. However, some may be present in water as a result of industrial or other discharges. A small number of metals have public health significance.

Of those parameters discussed above for which there are ODWO, none exceeded the Objectives except for organic nitrogen. Nor did the levels exceed any guidelines for drinking water set by other jurisdictions, such as the U.S. Environmental Protection Agency (US EPA), the World Health Organization (WHO) and Health & Welfare, Canada (H&W, Canada). Furthermore, the results of these analyses are consistent with those obtained in other areas of the Great Lakes.

(b) Organic Substances

Of a total of 474 analyses for volatile organic compounds, only 40 were positive; 32 of these were from treated water samples and were all due to the presence of trihalomethanes. Due to possible prechlorination and inaccurate sampling technique, trihalomethanes were present in the raw samples, as well as treated on June 9, 1986 and August 5, 1986.

Trihalomethanes (THMs) are acknowledged to be produced during the water treatment process and will almost always only occur in treated waters. Trihalomethanes are comprised mainly of chloroform, chlorodibromomethane and dichlorobromomethane with bromoform occurring occasionally. Results are reported for the individual compounds as well as for their sum, which is expressed as total trihalomethanes (total THM). The ODWO for total THM is 350 ug/L; this level was not exceeded in any of the water samples included in this report, the highest level recorded being 56 ug/L on August 5, 1986.

Four hundred and fourteen (414) tests were carried out for twenty three different pesticides; none was found above trace levels. Nine additional pesticides (propazine, atrazine, simazine, Sencor, Bladex, prometone, ametryne, prometryne and atratone) were analyzed for in both raw and treated water monthly. Metolachlor and alachlor were added to this monthly analysis on August 5, 1986. None of the above compounds was found above trace levels in either the raw or treated water samples. Seven special pesticides (dicamba, 2,4-DP, 2,4-D, Silvex, 2,4,5-T, 2,4-DB and picloram) were analyzed

for on two occasions (August 5, 1986 and October 6, 1986). Additional special pesticides were included on October 16, 1986 (Table 1A). None of the above compounds was found in any of the raw or treated water samples. The special pesticides analysis is carried out only once or twice a year at each supply, on a seasonal basis, to correspond to the use and/or loss of such pesticides on agricultural land.

Six chlorophenolic compounds (2,4,6-trichlorophenol, 2,4,5-trichlorophenol, 2,3,4-trichlorophenol, 2,3,5,6-tetrachlorophenol, 2,3,4,5-tetrachlorophenol and pentachlorophenol) were analyzed for on August 5, 1986 and October 6, 1986; none was found.

Of the 221 chloroaromatic tests conducted on raw and treated water, no positive results were obtained.

CONCLUSIONS

The data reveal that for metals, inorganic ions, and bacterial parameters, raw water values are frequently in the detectable range; levels of metals and inorganics are also found in treated water. The levels of metals, inorganic compounds, and bacteria are consistent with those found in other water supplies in the province.

For the organic compounds, most are below detection levels, even though the most sophisticated equipment available was employed in the chemical analysis.

ODWO have not been established for some of the compounds analysed; for these few compounds, use was made of appropriate guidelines set by other agencies, such as

the World Health Organization, the US Environmental Protection Agency, Health and Welfare Canada or other agencies. None of these guidelines was exceeded.

The treated water at the supply did not exceed any known health-related guidelines for organic substances applicable to drinking water.

Table 3

LAMBTON AREA (SARNIA) WTP DWSP RESULTS

02/11/87

PARAMETERS	UNITS		SAMPLE DATE 86/05/05	86/05/14	86/06/09	86/07/07	86/08/05	86/09/03	86/10/06	86/11/04	86/12/01			
ALKALINITY	MG/L-CAC	R	83.800	84.300	83.800	82.400		83.000	82.800	80.900	93.600			
		T	76.300		77.400	75.600		76.400	76.500	75.100	76.400			
ALUMINUM	MG/L-AL	R		.053	.023	.027	.067		.250	.310	.450			
		T	.051		.160	.210	.290	.250	.190	.140	.052			
ARSENIC	MG/L-AS	R							.001					
		T									.010			
BARIUM	MG/L-BA	R	.013	.013	.014	.014	.014	.014	.016	.015	.015			
		T	.013		.014	.014	.014	.014	.014	.013	.008			
BORON	MG/L-BO	R	.030	.020		.020		.020		.030	.030			
		T	.020		.030			.030	.020	.020	.030			
BERYLLIUM	MG/L-BE	R					.003							
		T												
CALCIUM	MG/L-CA	R	27.700	27.400	28.300	26.900	28.000	28.400	27.800	27.700	26.800			
		T	27.700		29.700	27.900	28.300	29.100	28.200	28.100	26.700			
CADMIUM	UG/L-CD	R					11.000							
		T												
CHLORIDE	MG/L-CL	R	5.700	5.800	6.500	6.000	7.000	6.000	5.500	5.000	5.500			
		T	6.750		7.500	7.500	7.500	7.500	7.500	6.500	6.500			
COLOUR	HZU	R			3.500									
		T												
CONDUCTIVITY	UMHO/CM	R	211.00	212.00	219.00	214.00	214.00	210.00	216.00	207.00	212.00			
		T	215.00		222.00	219.00	218.00	214.00	216.00	211.00	216.00			

Table 3 (cont'd)

LAMBTON AREA (SARNIA) WTP OWSP RESULTS

02/11/87

PARAMETERS	UNITS		SAMPLE DATE 86/05/05	86/05/14	86/06/09	86/07/07	86/08/05	86/09/03	86/10/06	86/11/04	86/12/01			
COBALT	MG/L-CO	R					.003							
		T												
CHROMIUM	MG/L-CR	R		.001			.002		.001		.001			
		T												
COPPER	MG/L-CU	R	.001		.130		.250		.002	.260	.170			
		T	.007		.006	.001	.009	.006	.008	.005	.006			
FECAL COLIFORM MEMBRANE FILTRATION	CT/100ML	R								1.000				
		T												
IRON	MG/L-FE	R	.023	.039	.073	.022	.150	020	.300	.460	.540			
		T	.016		.011	.006	.063	019	.095	.071	.031			
FLUORIDE	MG/L-F	R	.100	.090	.080	.080	.070	.080	.080	.080	.070			
		T	1.280		1.230	1.060	.910	1.040	.940	.820	1.040			
FIELD COMBINED CHLORINE RESIDUAL	MG/L-CL	R												
		T	.080		.090	.100	.030	.110	.110	.130	.090			
FIELD FREE CHLORINE RESIDUAL	MG/L-CL	R												
		T	.440		.600	.750	.760	.720	.800	.400	.720			
FIELD TOTAL CHLORINE RESIDUAL	MG/L-CL	R												
		T	.520		.690	.850	.790	.830	.910	.530	.810			
FIELD PH		R	7.600	7.700	7.860	7.830	8.070	7.850	8.020	7.820	8.230			
		T	7.200		7.400	7.310	7.420	7.510	7.500	7.500	7.480			
FIELD TEMPERATURE	DEG.C	R	5.000	10.000	11.000	1.600	21.000	20.500	16.000	11.000	5.600			
		T	6.000		12.000	17.000	22.000	21.000	17.000	12.000	8.000			
FIELD TURBIDITY	FTU	R	.700	1.400	2.100	7.450	.500	1.300	8.600	3.100	3.800			
		T	.090		.100	.090	.090	.090	.100	.100	.090			

Table 3 (cont'd)

LAMBTON AREA (SARNIA) WTP DWSP RESULTS 02/17/87

PARAMETERS	UNITS		SAMPLE DATE											
			86/05/05	[illegible]	86/06/09	[illegible]	86/08/05	86/09/03	86/10/06	86/11/04	86/12/01			
HARDNESS	MG/L-CAC	R	99.000	98.500	102.50	97.000	98.500	101.00	99.50	100.00	97.000			
		T	99.50		107.00	100.00	100.00	100.50	100.50	101.00	96.500			
STANDARD PLATE COUNT MEMBRANE FILT	CT/ML	R	260.00	[illegible]	2.000									
		T	11.000		118.00						170.00			
MERCURY	UG/L-HG	R			.010	.010	.010	.010	.010	.010	.010			
		T			.010	.010	.010	.010	.020	.010				
MAGNESIUM	MG/L-MG	R	7.250	7.300	7.750	7.250	6.950	7.250	7.300	7.500	7.250			
		T	7.400		7.950	7.300	7.100	7.350	7.250	7.450	7.300			
MANGANESE	MG/L-MN	R	.001	.001	.002	.001	.005	.001	.009	.009	.014			
		T	.001		.001		.002	.001	.005	.003	.001			
MOLYBDENUM	MG/L-MB	R				.001								
		T				.001								
SODIUM	MG/L-NA	R	3.400	3.500	4.800	3.900	3.500	4.500	3.600	3.600	3.500			
		T	3.200		4.000	3.700	3.600	3.800	3.500	3.500	3.400			
NICKEL	MG/L-NI	R					.014		.002					
		T												
AMMONIUM TOTAL	MG/L-N	R	.010	.024	.008			.020	.018	.014				
		T						.010	.008	.010				
NITRITE	MG/L-N	R	.005	.006		.006		.004	.003	.006				
		T				.002								
TOTAL NITRATES	MG/L-N	R	.335	.310	.310	.285	.295	255	295	.265	.280			
		T	.330		.310	.285	.290	.265	310	265	.280			

Table 3 (cont'd)

LAMBTON AREA (SARNIA) WTP DWSP RESULTS

02/17/87

PARAMETERS	UNITS		SAMPLE DATE 86/05/05	86/05/14	86/06/09	86/07/07	86/08/05	86/09/03	86/10/06	86/11/04	86/12/01		
NITROGEN TOTAL KJELDAHL	MG/L-N	R	.160	.160	.170	.170	.150	.180	.220	.400	.250		
		T	.110		.100	.090	.120	.120	.100	.150	.170		
LEAD	MG/L-PB	R							.003				
		T											
PH		R	8.240	8.330	8.320	8.300		8.270	8.290	8.260	8.270		
		T	7.870		8.170	7.840		8.100	8.080	7.930	8.050		
PHOSPHORUS FIL REACT	MG/L-P	R											
		T	.009		.008								
PHOSPHORUS TOTAL	MG/L-P	R				.009			.010		.014		
		T	.007		.012								
TOTAL SOLIDS	MG/L	R	137.00 CRO	138.00 CRO	142.00 CRO	162.00	139.00 CRO	137.00 CRO	159.00	129.00	169.00		
		T	140.00 CRO		144.00 CRO	164.00	142.00 CRO	139.00 CRO	140.00 CRO	137.00 CRO	140.00 CRO		
STRONTIUM	MG/L-SR	R	.099	.088	.100	.100	.110	.100	.100	.094	.095		
		T	.100		.110	.100	.110	.100	.100	.090	.057		
TOTAL COLIFORM MEMBRANE FILTRATION	CT/100ML	R				1.000		4.000	16.000	2.000	2.000 A3C		
		T											
TOTAL COLIFORM BACKGROUND MF	CT/100ML	R	2.000	2.000		370.00		30.000	160.00	2.000	8000.0		
		T											
TURBIDITY	FTU	R	1.090	1.620	2.800	1.210			8.500	5.300	22.000		
		T									.200		
URANIUM	UG/L-U	R						.230	.240	.230	.220		
		T					.240	.230	.220	.180	.170		
VANADIUM	MG/L-V	R					.020		.001		.001		
		T			.001								

Table 3 (cont'd)

LAMBTON AREA (SARNIA) WTP DWSP RESULTS 02/17/87

PARAMETERS	UNITS		SAMPLE DATE										
			86/05/05	86/05/14	86/06/09	86/07/07	86/08/05	86/09/03	86/10/06	86/11/04	86/12/01		
CHLOROFORM	UG/L	R			14.000		13.000						
		T	20.000		32.000	27.000	37.000	29.000	29.000	28.000	23.000		
DICHLOROBROMOMETHANE	UG/L	R			7.000		6.000						
		T	9.000		13.000	11.000	13.000	13.000	12.000	11.000	9.000		
CHLORODIBROMOMETHANE	UG/L	R			3.000		3.000						
		T	3.000		5.000	4.000	6.000	6.000	3.000	2.000	4.000		
TOTAL TRIHALOMETHANES	UG/L	R			24.000		22.000						
		T	32.000		50.000	42.000	56.000	48.000	44.000	41.000	36.000		
ZINC	MG/L-ZN	R	.002	.003	.011	.001	.025	.001	.006	.012	.011		
		T	.043		.024	.001	.025	.022	.040	.096	.028		